# Unit 7
# Linear Equations And Inequalities

## EXERCISE 7.1

**Q1. Solve the following equations.**

**(i)** $\frac{2}{3}x - \frac{1}{2}x = x + \frac{1}{6}$

**Solution;**

Multiplying both sides by 6 we get

$$4x - 3x = 6x + 1$$
$$x = 6x + 1$$
$$\Rightarrow \quad -5x = -\frac{1}{5}$$

Solution set = $\left\{-\frac{1}{5}\right\}$

**(ii)** $\frac{x-3}{3} - \frac{x-2}{2} = -1$

**Solution:**

Multiplying both sides by 6 we get

$$2(x-3) - 3(x-2) = -6$$
$$2x - 6 - 3x + 6 = -6$$
$$-x = -6$$
$$\Rightarrow \quad x = 6$$

Solution set = 6

**(iii)** $\frac{1}{2}\left(x - \frac{1}{6}\right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left(\frac{1}{2} - 3x\right)$

**Solution:**

$$\frac{1}{2}\left(\frac{6x-1}{6}\right) + \frac{2}{3} = \frac{5}{6} + \frac{1}{3}\left(\frac{1-6x}{2}\right)$$

Or $\frac{6x-1}{12} + \frac{2}{3} = \frac{5}{6} + \frac{1-6x}{6}$

Multiplying both sides by 12

$$6x - 1 + 8 = 10 + 2 - 12x$$
$$6x + 12x = 10 + 2 + 1 - 8$$
$$18x = 5$$
$$x = \frac{5}{18}$$

Solution set = $\left\{\frac{5}{18}\right\}$

**(iv)** $x + \frac{1}{3} = 2\left(x - \frac{2}{3}\right) - 6x$

**Solution:**

$$\frac{3x+1}{3} = 2\left(\frac{3x-2}{3}\right) - 6x$$
$$3x + 1 = 2(3x - 2) - 18x$$
$$3x + 1 = 6x - 4 - 18x$$
$$3x - 6x + 18x = -4 - 1$$
$$15x = -5$$
$$x = \frac{-5}{15} = -\frac{1}{3}$$

Solution set = $\left\{-\frac{1}{3}\right\}$

**(v)** $\frac{5(x-3)}{6} - x = 1 - \frac{x}{9}$

**Solution:**

Multiplying both sides by 18 we get
$$15(x - 3) - 18x = 18 - 2x$$
Or
$$15x - 45 - 18x = 18 - 2x$$
$$15x - 18x + 2x = 18 + 45$$
$$-x = 63$$
$$x = -63$$

Solution set = $\{-63\}$

**(vi)** $\frac{x}{3x-6} = 2 - \frac{2x}{x-2}$, $x \neq 2$



**Solution:**

Multiplying both sides by $3x - 6 = 3(x - 2)$, we get
$$x = 2(3x - 6) - 3(2x)$$
$$x = 6x - 12 - 6x$$
$$x = -12$$

Solution set = $\{-12\}$

**(vii)** $\frac{2x}{2x+5} = \frac{2}{3} - \frac{5}{4x+10}$ $\qquad x \neq -\frac{5}{2}$

**Solution:**

$$\frac{2x}{2x+5} = \frac{2}{3} - \frac{5}{2(2x+5)}$$

Multiplying both sides by $6(2x + 5)$ we get
$$6(2x) = 4(2x + 5) - 15$$
Or
$$12x = 8x + 20 - 15$$
$$x = \frac{5}{4}$$

So solution set = $\left\{\frac{5}{4}\right\}$

(viii) $\frac{2x}{x-1}+\frac{1}{3}=\frac{5}{6}+\frac{2}{x-1}$ $\quad x \neq 1$

**Solution:**

Multiplying both sides by $6(x-1)$ we get

$$6(2x)+2(x-1) = 5(x-1)+2(6)$$

or $12x+12-2 = 5x-5+12$

$14x-5x = -5+12+2$

$9x = 9$

$x = 1$

But it is given that $x \neq 1$

So the equation has no solution = { }

(ix) $\frac{2}{x^2-1}-\frac{1}{x+1}=\frac{1}{x+1}$, $\quad x \neq \pm 1$

**Solution:**

Multiplying both sides by $x^2-1$

$2-(x-1) = x-1$

$2-x+1 = x-1$

$-x-x = -1-2-1$

$-2x = -4$

$x = 2$

So solution set = {2}

(x) $\frac{2}{3x+6}=\frac{1}{6}-\frac{1}{2x+4}$, $\quad x \neq -2$

**Solution:**

$\frac{2}{3x+6}=\frac{1}{6}-\frac{1}{2(x+2)}$

Multiplying both sides by $6(x+2)$ we get

$2(2) = (x+2)-3$

$4 = x+2-3$

$4 = x-1$

$x = 5$

Solution set = {5}

**Q2. Solve each equation and check for extraneous solution, if any.**

**Extraneous solution:**

When raising each side of the equation to a certain power may produce a nonequivalent equation that has more solutions than the original equation. These additional solutions

are called extraneous solutions. We must check our answer(s) for such solutions when working with radical equations.

**(i)** $\sqrt{3x+4}=2$

**Solution:**

Taking square of both sides

$3x+4=4$

$3x=4-4$

$3x=0$

Or $x=0$

$\therefore$ Solution set = {0}

**(ii)** $\sqrt[3]{2x-4}-2=0$

**Solution:**

$\sqrt[3]{3x-4}=2$

Taking cube of both sides

$2x-4=2^3=8$

Or $2x=8+4$

$2x=12$

Or $x=6$

$\therefore$ Solution set = {6}

**(iii)** $\sqrt{x-3}-7=0$

**Solution:**

$\therefore$ $\sqrt{x-3}=7$

Taking square of both sides

$x-3=49$

$\Rightarrow$ $x=49+3$

Or $x=52$

$\therefore$ Solution set = {52}

**(iv)** $2\sqrt{t+4}=5$

**Solution:**

Taking square of both sides

$4(t+4)=25$

$4t+16=25$

$4t=25-16=9$

$t=\left\{\frac{9}{4}\right\}$

Solution set = $\left\{\frac{9}{4}\right\}$

**(v)** $\sqrt[3]{2x+3} = \sqrt[3]{x-2}$

**Solution:**

Taking cube of both sides

$2x + 3 = x - 2$

$2x - x = -2 - 3$

$x = -5$

$\therefore$ Solution set = $\{-5\}$

**(vi)** $\sqrt[3]{2-t} = \sqrt[3]{2t-28}$

**Solution:**

Taking cube on both sides

$2 - t = 2t - 28$

$-t - 2t = -28 - 2$

$-3t = -30$

$t = 10$

$\therefore$ Solution set = $\{10\}$

**(vii)** $\sqrt{2t+6} - \sqrt{2t-5} = 0$

**Solution:**

$\Rightarrow$ $\sqrt{2t+6} = \sqrt{2t-5}$

Taking Square of both sides

$2t + 6 = 2t - 5$

$11 = 0$ which is not possible

Solution set = $\{\ \}$ or $\phi$



**(viii)** $\sqrt{\frac{x+1}{2x+5}} = 2 \quad x \neq \frac{5}{2}$

**Solution:**

Squaring both sides

$\frac{x+1}{2x+5} = 4$

$x + 1 = 4(2x + 5)$

$\Rightarrow$ $x - 1 = 8x + 20$

$\Rightarrow$ $x - 8x = 20 - 1$

$-7x = 19$

$\Rightarrow$ $x = -\frac{19}{7}$

$\therefore$ Solution set = $\left\{-\frac{19}{7}\right\}$

# EXERCISE 7.2

**Q1. Identify the following statements as True or False.**

**(i)** $|x| = 0$ has only one solution.

**(ii)** All absolute value equations have two solutions.

**(iii)** The equation $|x| = 2$ is equivalent to $x = 2$ or $x = -2$.

**(iv)** The equation $|x - 4| = -4$ has no solution.

**(v)** The equation $|2x - 3| = 5$ is equivalent to $2x - 3 = 5$ or $2x + 3 = 5$.

**Answers:**

| (i) T | (ii) F | (iii) T | (iv) T | (v) F |
|---|---|---|---|---|

**Q2. Solve for $x$.**

**(i)** $|3x - 5| = 4$

**Solution:**

The equation is equivalent to

$3x - 5 = 4$ Or $3x - 5 = -4$

$3x = 9$ Or $3x = 1$

$x = 3$ Or $x = \frac{1}{3}$

Solution set $= \left\{3, \frac{1}{3}\right\}$

**(ii)** $\frac{1}{2}|3x + 2| - 4 = 11$



**Solution:**

$\frac{1}{2}|3x + 2| = 15$

$|3x + 3| = 30$

The equation is equivalent to

$3x + 2 = 30$ or $3x + 2$

$x = 30 - 2$ or $3x = -30 - 2$

$3x = 28$ or $3x = -32$

$x = \frac{28}{3}$ or $x = \frac{-32}{3}$

Solution set $= \left\{\frac{28}{3}, -\frac{32}{3}\right\}$

**(iii)** $|3x + 5| = 11$

**Solution:**

The given equation is equivalent to

$2x + 5 = \pm 11$

i.e. $2x + 5 = 11$ or $2x + 5 = -11$

$2x = 6$ or $2x = -16$

$x = 3$ or $x = -8$

$\therefore$ Solution set = $\{-8, 3\}$

**(iv)** $|3 + 2x| = |6x - 7|$

**Solution:**

The given equation is equivalent to

$3 + 2x = \pm(6x - 7)$

i.e. $3 + 2x = 6x - 7$ or $3 + 2x = -6(6x - 7)$

i.e. $2x - 6x = -7$ or $2x + 6x = 7 - 3$

i.e. $-4x = -10$ or $8x = 4$

$x = \frac{5}{2}$ or $x = \frac{1}{2}$

Solution set $\left\{\frac{5}{2}, \frac{1}{2}\right\}$

**(v)** $|x + 2| - 3 = 5 - |x + 2|$

**Solution:**

$\Rightarrow$ $|x + 2| + |x + 2| = 5 + 3$

$2|x + 2| = 8$

$|x + 2| = 4$

This equation is equivalent to

$x + 2 = 4$ *or* $x + 2 = -4$

$x = 2$ *or* $x = -6$

Solution set = $\{2, -6\}$



**(vi)** $\frac{1}{2}|x + 3| + 21 = 9$

**Solution:**

$\frac{1}{2}|x + 3| = 9 - 21 = -12$

$|x + 3| = -6$ Which is not possible

Since the absolute value of non-zero integer is always positive.

Solution set = $\{\ \}$ *or* $\phi$

**(vii)** $\left|\frac{3x-5}{4}\right| - \frac{1}{3} = \frac{2}{3}$

**Solution:**

$\left|\frac{3-5x}{4}\right| = \frac{2}{3} + \frac{1}{8} = 1$

The given equation is equivalent to

$\left|\frac{3-5x}{4}\right| = \pm 1$

or $3 - 5x = \pm 4$

i.e. $3 - 5x = 4$ or $3 - 5x = -4$

$-5x = 4$ or $-5x = -4 - 3$

$-5x = 1$ or $-5x = -7$

$x = -\frac{1}{5}$ or $x = \frac{7}{5}$

Solution set = $\left\{-\frac{1}{7}, \frac{7}{5}\right\}$

**(viii)** $\left|\frac{x+5}{2-x}\right| = 6$

**Solution:**

The given equation is equivalent to

$\frac{x+5}{2-x} = \pm 6$

i.e. $x + 5 = \pm 6(2 - x)$

i.e. $x + 5 = 6(2 - x)$

or $x + 5 = -6(2 - x)$

$x + 5 = 12 - 6x$ or $x + 5 = -12 - 5$

$x + 6x = 12 - 5$ or $x - 6x = -12 - 5$

$x = 7$ or $-5x = -17$

$x = 1$ or $x = \frac{17}{5}$

Soluton set = $\left\{1, \frac{17}{5}\right\}$



## EXERCISE 7.3

**Q1. Solve the following inequalities.**

**(i)** $3x + 1 < 5x - 4$

**Solution:**

$3x - 5x < -4 - 1$

$-2x < -5$

$-2x > 5$

$x > \frac{5}{2}$

Solution set is $\left\{x \mid x > \frac{5}{2}\right\}$

**(ii)** $4x - 10.3 \leq 21x - 1.8$

**Solution:**

$4x - 21x \leq -1.8 + 10.3$

$17x \leq 8.5$

$x \geq -0.5$

Solution set is $\{x \mid x \geq -0.5\}$

**(iii)** $4-\frac{1}{2}x \geq -7+\frac{1}{4}x$

**Solution:**

$$-\frac{1}{2}x-\frac{1}{4}x \geq -7-4$$

$$-\frac{3}{4}x \geq -11$$

$$\frac{3}{4}x \geq -11$$

Or $x \leq \frac{44}{3}$

$\therefore$ Solution set is $\left\{x \middle| x \leq \frac{44}{3}\right\}$

**(iv)** $x-2(5-2x) \geq 6x-3\frac{1}{2}$

**Solution:**

$$x-0+4x \geq 10-\frac{7}{2}$$

$$5x-6x \geq 10-\frac{7}{2}$$

$$-x \geq \frac{13}{2}$$

$$-x \geq 6.5$$

$$x \leq -6.5$$

Solution set is $\{x|x \leq -6.5\}$

**(v)** $\frac{3x+2}{9}-\frac{2x+1}{3} > -1$

**Solution:**

Multiplying both sides by 9

$$3x+2-3(2x+1) > -9$$

$$3x+2-6x-3 > -9$$

$$3x-6x > -9-2+3$$

$$-3x < -8$$

$$3x < 8$$

$$x < \frac{8}{3}$$

Solution set $\left\{x \mid x < \frac{8}{3}\right\}$

**(vi)** $3(2x+1)-2(2x+5) < 5(3x-2)$

**Solution:**

$$6x+3-4x-10 < 15x-10$$

$$2x-7 < 15x-10$$

$$2x-15x < -10+7$$

$$-13x < -3$$

$$x > \frac{3}{13}$$

Solution set $\left\{x \mid x > \frac{3}{13}\right\}$

**(vii)** $3(x-1)-(x-2) > -2(x+4)$

**Solution:**

$$3x - 3 - x + 2 > -2x - 8$$
$$2x - 1 > -2x - 8$$
$$2x + 2x < -8 + 1$$
$$4x > -\frac{7}{4}$$

Solution set is $\left\{x \mid x > -\frac{7}{4}\right\}$

**(viii)** $2\frac{2}{3}x + \frac{2}{3}(5x-4) > -\frac{1}{3}(8x+7)$

**Solution:**

$$\frac{8}{3}x + \frac{10}{3}x - \frac{8}{3} > -\frac{8}{3}x - \frac{7}{3}$$

Multiplying by 3

$$8x + 10x - 8 > -8x - 7$$
$$18x - 8 > -8x - 7$$
$$18x + 8x > -7 + 8$$
$$26x > 1$$
$$x > \frac{1}{26}$$



Solution set is $\left\{x \mid x > \frac{1}{26}\right\}$

**Q2. Solve the following inequalities.**

**(i)** $-4 < 3x + 5 < 8$

**Solution:**

The given equality represents two inequalities

$$-4 < 3x + 5$$

and $$3x + 5 < 8$$

The first inequality $-4 < 3x + 5$ gives

$$-3x < 5 + 4$$
$$3x > -9$$
$$x > -\frac{9}{3}$$
$$x > -3$$

Or $$-3 < x \quad \text{(i)}$$

The second inequality $3x + 5 < 8$ gives

$$3x < 8 - 5$$

$$3x < 3$$

Or $\quad x < 1 \quad$ (ii)

Combining (i) and (ii), we have

$$-3 < x < 1$$

Solution set is $\{x \mid -3 < x < 1\}$

**(ii)** $\quad -5 \le \frac{4-3x}{2} < 1$

**Solution:**

The given inequality represents two inequalities

$$-5 \le \frac{4-3x}{2}$$

And $\quad \frac{4-3x}{2} < 1$

The first inequality gives

$$-5 \le \frac{4-3x}{2}$$

$$-10 \le 4 - 3x$$

$$-10 - 4 \le -3x$$

$$14 \ge 3x$$

Or $\quad \frac{14}{3} \ge x \quad$ (i)

The second inequality gives $\frac{4-3x}{2} < 1$

$\Rightarrow \quad 4 - 3x < 2$

$4 - 2 < 3x$

$2 < 3x$

$\Rightarrow \quad \frac{2}{3} < x$

Combining (i) and (ii)

$\frac{2}{3} < x \le \frac{14}{3}$

Solution set is $\left\{x \mid \frac{2}{3} < x < \frac{14}{3}\right\}$

**(iii)** $\quad -6 < \frac{x-2}{4} < 6$

**Solution:**

This inequality is equivalent to two inequalities

$$-6 < \frac{x-2}{4}$$

And $\quad \frac{x-2}{4} < 6$

The first inequality gives

$$-24 < x - 2$$

$\Rightarrow \quad -24 + 2 < x$

$\Rightarrow$ $-22 < x$ (i)

The second inequality gives

$x - 2 < 24$

$x < 24 + 2$

Or $x < 26$ (ii)

Combining (i) and (ii) we have

$-22 < x < 26$

Solution set is $\{x \mid -22 < x < 26\}$

**(iv)** $3 \geq \frac{7-x}{2} \geq 1$

**Solution:**

This inequality represents two inequalities $3 \geq \frac{7-x}{2}$ and $\frac{7-x}{2} \geq 1$. The first inequality gives

$6 \geq 7 - x$

$\Rightarrow$ $6 - 7 \geq -x$

$\Rightarrow$ $-1 \geq -x$

Or $1 \leq x$ (i)

The second inequality gives

$7 - x \geq 2$

$-x \geq 2 - 7$

$\Rightarrow$ $-x \geq -5$

Or $x \leq 5$ (ii)

Combining (i) and (ii) we have

$1 \leq x \leq 5$

$\therefore$ The Solution set is $\{x \mid 1 \leq x \leq 5\}$

**(v)** $3x - 10 \leq 5 \leq x + 3$

**Solution:**

The inequality is equivalent to

$3x - 10 \leq 5$

And $5 < x \pm 3$

The first inequality gives

$3x - 10 \leq 5$

$\Rightarrow$ $3x \leq 5 + 10$

Or $3x \leq 15$

Or $x \leq 5$ (i)

The second inequality gives

$5 < x + 3$

Or $5 - 3 < x$

Or $2 < x$ (ii)

Combining (i) and (ii) we have

$2 < x \leq 5$

the solution set is $\{x \mid 2 < x \leq 5\}$

**(vi)** $-3 \leq \frac{x-4}{-5} < 4$

**Solution:**

This equation is equivalent to

$-3 \leq \frac{x-4}{-5}$

And $\frac{x-4}{-5} < 4$

The first inequality gives

$-3 \leq \frac{x-4}{-5}$

$\Rightarrow$ $15 \geq x - 4$

Or $15 + 4 \geq x$

$\Rightarrow$ $19 \geq x$

Or $x \leq 19$ (i)

This second inequality gives

$\frac{x-4}{-5} < 4$

Or $x - 4 > -20$

$\Rightarrow$ $x > -20 + 4$

Or $x > -16$

Or $-16 < x$ (ii)

Combining (i) and (ii) we have

$-16 < x \leq 19$

$\therefore$ the solution set is $\{x \mid -16 < x \leq 19\}$

**(vii)** $1 - 2x < 5 - x \leq 25 - 6x$

**Solution:**

This inequality is equivalent to

$1 - 2x < 5 - x$

And $5 - x \leq 25 - 6x$

The first inequality gives

$1 - 2x < 5 - x$

Or $-2x + x < 5 - 1$

Or $-x < 4$ or $x > -4$

or $-4 < x$ (i)

The second inequality gives

$5 - x \leq 25 - 6x$

$\Rightarrow \quad -x + 6X \leq 25 - 5$

Or $\quad 5x \leq 20$

$\Rightarrow \quad x \leq 4 \qquad$ (ii)

Combining (i) and (ii) we have

$-4 < x \leq 4$

$\therefore$ the solution set is $\{x| -4 < x \leq 4\}$

**(viii)** $3x - 2 < 2x + 1 < 4x + 17$

**Solution:**

This is equivalent to

$3x - 2 < 2x + 1$

And $\quad 2x + 1 < 4x + 17$

The first inequality gives

$3x - 2 < 2x + 1$

or $\quad 3x - 2x < 1 + 2$

or $\quad x < 3$

The second inequality gives

$2x + 1 < 4x + 17$

$2x - 4x < 17 - 1$

or $\quad -2x > 16$

or $\quad 2x > -16$

or $\quad x > -8$

or $\quad -8 < x \qquad$ (ii)

Combining (i) and (ii) we have

$-8 < x < 3$

solution set is $\{x| -8 < x < 3\}$



## REVIEW EXERCISE 7

**Q1. Choose the correct answer.**

**(i) Which of the following is the solution of the inequality $-4x \leq 11$ ?......**

(a) -8 (b) -2

(c) -4 (d) None of these

**(ii) A statement involving any of the symbols $<, >, \leq$ or $\geq$ is called ......**

(a) equation (b) identity

(c) inequality (d) linear equation

**(iii)** **$x =$ ...... is a solution of the inequality $-2 < x < \frac{3}{2}$**

(a) -5 (b) 3

(c) 0 (d) $\frac{3}{2}$

**(iv)** **If $x$ is no larger than 10, then......**

(a) $x > 8$ (b) $x < 10$

(c) $x < 10$ (d) $x > 10$

**(v)** **If the capacity $c$ of an elevator is at most 1600 pounds, then......**

(a) $c < 1600$ (b) $c > 1600$

(c) $c < 1600$ (d) $c > 1600$

**(vi)** **$x = 0$ is a solution of the inequality......**

(a) $x > 0$ (b) $3x + 5 < 0$

(c) $x + 2 < 0$ (d) $x - 2 < 0$

**Answers:**

| (i) b | (ii) c | (iii) c | (iv) b | (v) c | (vi) d |
|---|---|---|---|---|---|

**Q2. Identify the following statements as True or False.**

**(i)** The equation $3x - 5 = 7 - x$ is a linear equation.

**(ii)** The equation $x - 0.3x = 0.7x$ is an identity.

**(iii)** The equation $-2x + 3 = 8$ is equivalent to $-2x = 11$.

**(iv)** To eliminate fractions, we multiply each side of an equation by the L.C.M. of denominators.

**(v)** $4(x + 3) = x + 3$ is a conditional equation.

**(vi)** The equation $2(3x + 5) = 6x + 12$ is ah inconsistent equation.

**(vii)** To solve $\frac{2}{3}x = 1.2$, we should multiply each side by $\frac{2}{3}$.

**(viii)** Equations having exactly the same solution are called equivalent equations.

**(ix)** A solution that does not satisfy the original equation is called extraneous solution.

**Answers:**

| (i) T | (ii) T | (iii) F | (iv) T | (v) T |
|---|---|---|---|---|
| (vi) T | (vii) F | (viii) T | (ix) T | |

**Q3. Answer the following short questions.**

**(i) Define linear inequality in one variable.**

**Solution:**

A linear inequality in one variable x is an inequality in which the variable x occurs only to the first power and is of the form

$$ax + b < 0 \quad , \quad a \neq 0$$

where a and b are equal real numbers.

**(ii) State the Trichotomy and transitive properties of inequalities.**

**Solution:**

**Law of Trichotomy**

For any $a, b \in R$, one and only of the statements is true.

$$a < b \quad or \;\; a = b \quad or \; a > b$$

**Transitive Property**

Let $a, b, c \in R$

**(a)** if $a > b$ and $b > c$ then $a > c$

**(b)** if $a <$and $b < c$ then $a < c$

**(iii) The formula relating degrees Fahrenheit to degrees Celsius is $F = \frac{9}{5}C + 32$. For what value of $C$ is $F < 0$?**



**Solution:**

$F = \frac{9}{5}C + 32$

$F < 0$

⇒ $\frac{9}{5}C + 32$

Or $9c + 160 < 0$

Or $9c + 160 < 0$

Or $9c < -160$

Or $C < \frac{-160}{9}$

**(iv) Seven times, the sum of an integer and 12 is at least 50 and at most 60. Write and solve the inequality that expresses this relationship.**

**Solution:**

Let x be the integer. So according to the question

$$50 \leq 7(x + 12) \leq 60$$

This is equivalent to two inequalities

$$50 \leq 7(x+2)$$

And $\quad 7(x+12) \leq 60$

The first inequality gives

$$50 \leq 7(x+12)$$

$$50 \leq 7x+84$$

$$50-84 \leq 7x$$

Or $\quad -34 \leq 7x$

$\Rightarrow \quad -\frac{34}{7} \leq x \qquad$ (i)

The second inequality gives

$$7(x+12) \leq 60$$

$$7x+84 \leq 60$$

Or $\quad 7x \leq 60-84$

Or $\quad 7x \leq 60-84$

$\Rightarrow \quad x \leq -\frac{24}{7} \qquad$ (ii)

From (i) and (ii) we get

$$-\frac{34}{7} \leq x \leq -\frac{24}{7}$$

the required integer is $x| \quad -\frac{34}{7} \leq x \leq -\frac{24}{7}$



**Q4. Solve each of the following and check for extraneous solution if any:**

**(i)** $\sqrt{2t+4} = \sqrt{t-1}$

**Solution:**

Squaring both sides

$$2t+4 = t-1$$

Or $\quad 2t-t = -1-4$

Or $\quad t = -5$

On checking

$$\sqrt{-10+4} = \sqrt{-5-1}$$

$$\sqrt{-6} = \sqrt{-6}$$

Since $\sqrt{-6} = \infty$ = Imaginary

Therefore solution set = { }

**(ii)** $\sqrt{3x-1} - 2\sqrt{8-2x} = 0$

**Solution:**

$\Rightarrow \quad \sqrt{3x-1} = 2\sqrt{8-2x}$

Squaring both sides

$$3x-1 = 4(8-2x)$$

Or $\quad 3x-1 = 32-8x$

Or $3x + 8x = 32 + 1$

$11x = 33$

$\Rightarrow$ $x = 3$

**Check:**

$$\sqrt{3(3-1} - 2\sqrt{8-2(3)} = 0$$
$$\sqrt{9-1} - 2\sqrt{8-6} = 0$$
$$\sqrt{8} - 2\sqrt{2} = 0$$
$$2\sqrt{2} - 2\sqrt{2} = 0$$

$x = 3$ satisfies the given equation

So the solution set is $\{3\}$

**Q5. Solve for $x$**

**(i)** $|3x + 14| - 2 = 5x$

**Solution:**

Or $|3x + 14| = 5x + 2$

This is equivalent to

$3x + 14 = \pm(5x + 2)$

i.e. $3x + 14 = 5x + 2$ or $3x + 14 = -(5x + 2)$

$3x - 5x = 2 - 14$ or $3x + 14 = -5x - 2$

$-2x = -12$ or $3x + 5x = -2 - 14$

$x = 6$ or $8x = -16$

$x = 6$ or $x = -2$

On checking we see that $x = 6$ satisfies the given equation but $x = -12$ does not satisfy the given equation. So the solution set is $\{6\}$

**(ii)** $\frac{1}{3}|x - 3| = \frac{1}{2}|x + 20|$

**Solution:**

Multiplying both sides by 6 we get

$2|x - 3| = 3|x + 2|$

This is equivalent to

$2|x + 3| = \pm 3(x + 2)$

Which is equivalent to

$2(x - 3) = 3(x + 2)$ or $2(x - 3) = -3(x + 2)$

$2x - 6 = 3x + 6$ or $2x - 6 = -3x - 6$

$2x - 3x = 6 + 6$ or $2x + 3x = -6 + 6$

$-x = 12$ or $5x = 0$

$x = -12$ or $x = 0$

On checking $x = -12$

On checking we see that $x = 0$ and $x = -12$ satisfies the given equation.

$\therefore$ solution set is $\{-12, 0\}$

**Q6. Solve the following inequality**

**(i)** $-\frac{1}{3}x + 5 \leq 1$

**Solution:**

Multiplying by 3

$$-x + 15 \leq 3$$

Or $-x \leq 3 - 15$

or $-x \leq 3 - 15$

$\Rightarrow$ $x \geq 12$

So the solution set is $\{x \mid x \geq 12\}$

**(ii)** $-3 < \frac{1-2x}{5} < 1$

**Solution:**

This is equivalent to two inequalities

$$-3 < \frac{1-2x}{5}$$

And $\frac{1-2x}{5} < 1$

The first inequality gives

$$-15 < 1 - 2x$$

$\Rightarrow$ $2x < 1 + 15$

Or $2x < 16$

$\Rightarrow$ $x < 8$

The second inequality gives

$$1 - 2x < 5$$

$$-2x < 5 - 1$$

Or $-2x > 4$

$\Rightarrow$ $-2x > 4$

$\Rightarrow$ $x > -2$

Combining (i) and (ii) we have

$$8 > x > -2$$

Or $-2 < x < 8$

$\therefore$ solution set is $\{x \mid 8 > x > -2\}$